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The National Numeracy Strategy: the first three years 1999–2002

HMI 554

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Introduction and evidence base

1. The implementation of the National Numeracy Strategy (NNS) began in English primary schools at the start of the autumn term of 1999. The purpose of the strategy is to improve standards in mathematics. The Department for Education and Skills (DfES) set a national target that, by 2002, 75% of 11 year olds should reach the standard expected for their age (level 4) in the end of Key Stage 2 national curriculum tests.

2. This report provides an overview of the first three years and is the fourth report on the NNS published by Ofsted. It summarises the standards attained by pupils; analyses the changes in teaching methods brought about by the strategy; and suggests areas where further work is needed.

3. Ofsted, through Her Majesty's Inspectors (HMI), inspected the implementation and impact of the NNS in a nationally representative sample of 300 primary schools from 1999 to 2002. The sample was reduced to 200 schools in the second year of implementation. The schools were visited at least once a year over the course of the evaluation. HMI observed the teaching of mathematics and held discussions with key personnel. HMI also inspected training and regularly met NNS mathematics consultants, their line managers in local education authorities (LEAs) and the regional directors of the strategy. Evidence from section 10 inspections and from a telephone survey of 50 headteachers was also taken into account.

4. Complementing the inspections by HMI, the Qualifications and Curriculum Authority (QCA) established an annual testing programme to provide data on pupils' attainment and progress in mathematics in Years 3, 4 and 5 in all 300 schools. These data, collected and analysed by the National Foundation for Education Research (NFER), augment those already available through the national curriculum tests of Year 2 and Year 6 pupils. An annex to this report, produced by the QCA, summarises the results of the mathematics tests taken by the pupils in Years 3, 4 and 5. A fuller version is available on the QCA web site (www.qca.org.uk).

5. HMI intend to continue to monitor and report on the National Numeracy Strategy from 2002 to 2004 in a new national sample of schools.

Main findings

- The National Numeracy Strategy has had a significant impact on the standards attained in mathematics and on the quality of teaching over the last three years. It has enabled the government to come close to, but not to hit, its target, namely that 75% of 11 year olds should attain at least level 4 in mathematics in the 2002 national curriculum tests.

- The quality of teaching has improved steadily over the three years, although the biggest improvement was made in the first year of implementation. The quality of teaching is now at least satisfactory in nine in ten lessons and good in six in ten.

- The oral and mental starter remains the best-taught element of the daily mathematics lesson. The proportion of lessons where it is unsatisfactory has fallen over the last three years from one in eight to one in 12. The main feature of good teaching continues to be the development of pupils' rapid recall of number facts. However, teachers still give insufficient attention to teaching mental calculation strategies.

- The quality of teaching in the main activity has improved steadily since the first year of the strategy. It is unsatisfactory now in only one in nine lessons. More teachers make the objectives clear to pupils and use the time in this part of the lesson effectively.

- The plenary session is still the weakest part of the daily mathematics lesson. One in six plenary sessions is weak. There are also weaknesses more generally in teachers' assessment of pupils' progress, although there are signs of improvement in around two in three schools. Teachers do not do enough to diagnose pupils' difficulties or use this information to adjust their teaching.

- Many teachers have improved their knowledge and confidence in teaching mathematics. There are still weaknesses, however, which restrict their ability to help pupils to overcome their difficulties and improve their understanding. The strategy, rightly, has given priority to providing more five-day training courses to improve teachers' subject knowledge.

- Schools are now more aware of how to use ICT in mathematics, but progress is slow. Improving teachers' expertise and confidence in using ICT continues to be a challenge for many schools.

- Pupils' confidence, enjoyment of and involvement in mathematics have improved since the strategy began. They respond positively to the routines and clear structure of the daily mathematics lesson and they are motivated by the direct teaching which it requires. Many pupils understand their strengths and weaknesses in mathematics better, as well as the progress they are making.

- As in 2001, teaching assistants continue to contribute positively to the teaching of the daily mathematics lesson and give good support to teachers and pupils. Most teaching assistants have received training to improve their subject knowledge and questioning skills in mathematics, and to enable them to work effectively with teachers and pupils.

- The leadership and management of the strategy remain unsatisfactory in one in eight schools. If this figure were extrapolated to schools nationally, this would represent nearly 2000 schools. This figure has not changed over the three years of implementation. The conferences held by LEAs for headteachers in the autumn term 2001, which focused on school improvement, had too little impact. There are also around one in six mathematics co-ordinators who have not made enough difference to teaching and standards in their schools.

- The strategy's training, especially the five-day training courses, has had a positive impact on the quality of teaching, particularly where it has been adapted to meet needs identified during the course of implementation. Many teachers have become more confident in teaching mathematics as a result.

- LEA numeracy consultants have played a key role in ensuring that the strategy has been introduced successfully. Most consultants have provided good-quality support, including training, demonstration lessons, joint observations with mathematics co-ordinators and guidance on target-setting.

- LEAs have played an important part in implementing the strategy, particularly through focusing carefully the work of NNS consultants and the good use of the strategy's training programmes to meet local needs. Many LEAs are now more rigorous in assessing the level of support schools need.

- The proportion of 11 year olds reaching level 4 or above in mathematics this year has risen by two percentage points to 73%. This means that since the introduction of the strategy in 1999, the proportion of pupils reaching level 4 in the national tests at the end of Key Stage 2 has risen from 58% to 73%. The proportion of pupils gaining level 5 has also risen this year by three percentage points and now stands at 28%, after an initial rise of seven percentage points in 1999.

- At Key Stage 1, the proportion of pupils gaining level 2 or above since 1999 has risen from 85% to 90%, although there has been a fall of one percentage point since 2001. At level 2B, the increase since 1999 has been from 61% to 76%, an increase of one percentage point since last year. There has been a steady increase in the proportion of pupils gaining level 3. This year, 31% of pupils gained this level, with boys ahead of girls by four percentage points.

- There has been a substantial increase since 1998 in the proportion of LEAs in which more than 75% of pupils reached at least level 4 in mathematics. Only 33 LEAs have made progress in mathematics each year since 1998.

Points for action

6. To build upon the improvements in teaching and raise standards further, those with national responsibility for the management of the strategy should:

- continue to expand access for teachers to the five-day training, with the emphasis on improving subject knowledge and techniques for teaching and day-to-day assessment
- improve the take-up and use of NNS training and teaching materials in schools
- continue to give high priority to improving the leadership and management of headteachers and co-ordinators in the schools where these aspects remain weak
- continue to provide training to develop schools' use of ICT to support the teaching of mathematics.

7. Those with responsibility for the strategy at LEA level should:

- increase the challenge and support for those schools which are underperforming and need to make better progress
- ensure that consultants' support for schools forms part of a coherent action plan for mathematics which schools are committed to following through systematically
- be more active in disseminating the strategy's key messages and promoting the effective use of its resources and materials, seeing this as a matter for the whole-school improvement service.

8. To build on the progress made so far, schools should:

- improve the day-to-day assessment of pupils' learning so that teachers know how and what to assess in their mathematics lessons
- use the monitoring of teaching to identify weaknesses in teachers' subject knowledge and provide support and training where they are needed
- give more support to mathematics co-ordinators and define their responsibilities more clearly
- focus the strategy's intervention and support programmes on pupils who are most likely to be able to catch up with the rest of the class and link them more closely with the school's mainstream provision
- improve the contribution of ICT to teaching and learning in mathematics.

9. In addition, schools where attainment in mathematics is still too low should:

- draw up an action plan to raise standards in mathematics, using the full range of assessment data to establish priorities, time-scales and training needs
- set numerical and curricular targets, clarify how these will be used by teachers and pupils and how their impact will be monitored and evaluated.

Standards of achievement and pupils' progress

10. The proportion of pupils reaching level 4 or above in mathematics at the end of Key Stage 2 this year has increased by two percentage points to 73%. This means that there is a gap of two percentage points between this year's results and the government's target that 75% of pupils should gain level 4 by the age of 11.

11. There has been an improvement of three percentage points since 2001 in the proportion of pupils achieving level 5 and above in mathematics, which now stands at 28%. More boys than girls (30% and 25% respectively) reached this higher level.

12. Figures 1 and 2 illustrate the results in mathematics at Key Stage 2 from 1998 to 2002.

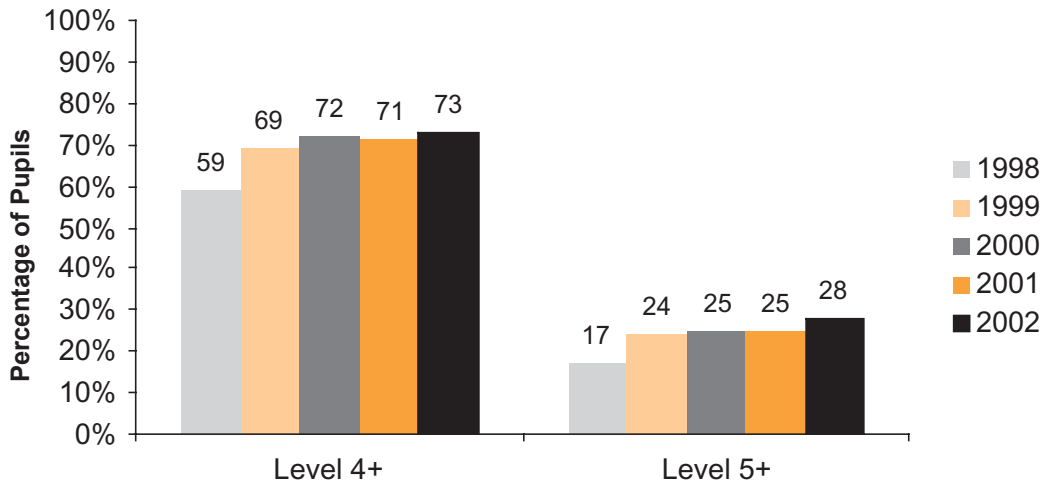

Figure 1. Attainment in national curriculum mathematics tests at Key Stage 2: all pupils

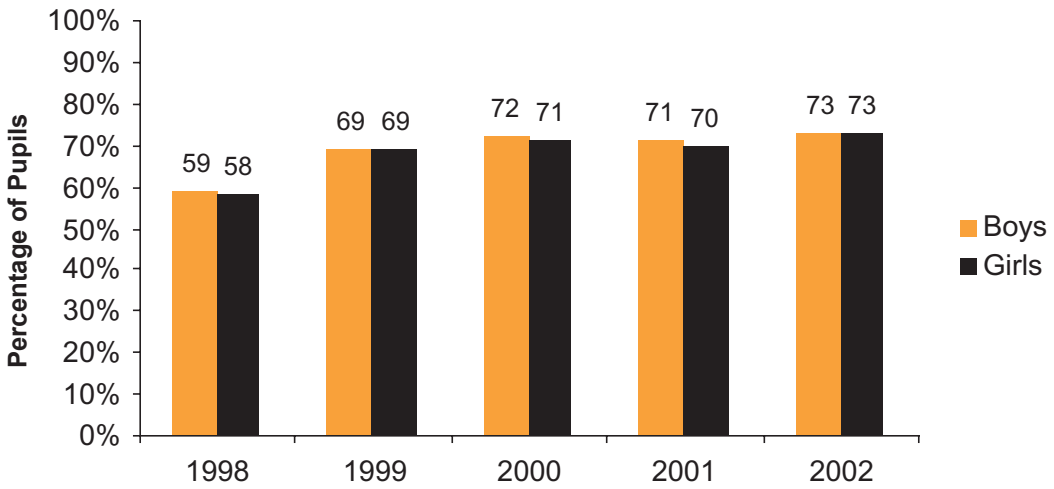

Figure 2. Percentage of pupils achieving level 4 and above in mathematics tests at Key Stage 2: boys and girls

13. At Key Stage 1, there was a decrease of one percentage point since 2001 in the proportion of pupils achieving level 2 or above. At this level, girls continue to achieve slightly better than boys: 92% of girls achieved at least level 2, compared with 89% of boys. However, at the higher levels, boys do better than girls: 33% of boys achieved level 3 compared with 29% of girls.

14. Level 2 covers a wide range of attainment. At the more demanding benchmark of level 2B, 76% of pupils reached this level and, as in previous years, this figure has again increased. One in four pupils still transfers to Key Stage 2 with attainment below level 2B, indicating that there is still considerable work to be done in Year 3 and beyond if pupils are to progress to level 4 in mathematics by the age of 11.

15. Figures 3 and 4 illustrate the results in mathematics at Key Stage 1 from 1998 to 2002.

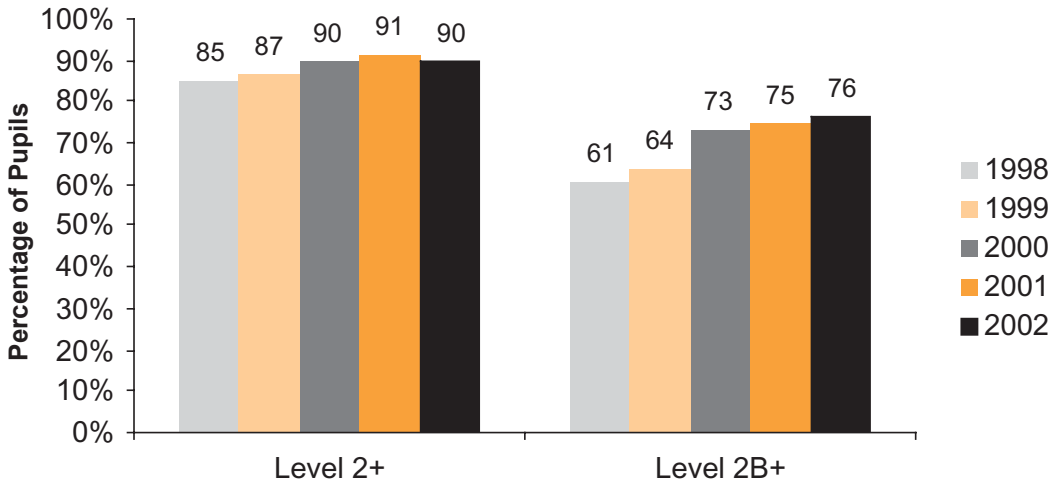

Figure 3. Attainment in national curriculum mathematics tests at Key Stage 1: all pupils

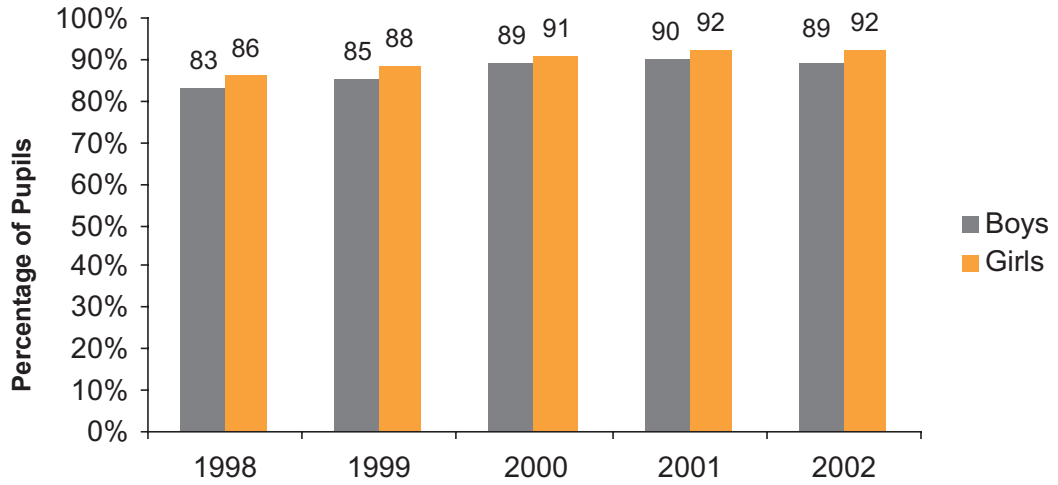

Figure 4. Percentage of pupils achieving level 2 and above in mathematics tests at Key Stage 1: boys and girls

16. Since 1998, there has been an upward trend in the performance of the majority of LEAs. There has been a substantial increase in the proportion of LEAs in which more than 75% of pupils reached at least level 4 in mathematics. In 2002, LEA results in Year 6 at level 4 and above in mathematics ranged from an improvement since 2001 of seven percentage points to a decline of about three points. Overall, 124 LEAs improved upon their 2001 Key Stage 2 results while seven showed a decline and 14 remained unchanged. Since 1998, only 33 LEAs have made progress every year.

17. The analysis by NFER of the specially commissioned tests for schools in the national sample shows minor changes in 2002, indicating a levelling of pupils' performance. There have also been minimal changes to the number of pupils failing to reach the lowest level measured by the tests in Years 3, 4 and 5. In 2002, 37% of pupils in Year 3 were achieving level 3 or more, an increase of one percentage point from the previous year. There was no change in Year 4, where 70% of pupils were achieving level 3 or more. Year 5 had similar results to Year 3, showing an increase of one percentage point from the previous year, with nearly half of all pupils achieving level 4 or better.

18. Since 1999, the proportions of pupils achieving higher levels has increased by a third in all year groups. By 2002, nearly half of all Year 5 pupils in the sample were already working at level 4 or better. A similar trend can be seen in those pupils achieving the lowest level over the same period, where the proportion fell by a third. Through the use of matching exercises in the sample schools, it has been possible to track pupils' progress from 2001 through to Key Stage 2 in 2002. This shows that 78% of pupils in Year 5 who were achieving level 3 were achieving level 4 or better in Year 6. Of the Year 5 pupils who were already achieving level 4, 62% progressed to at least level 5 when they were tested in Year 6.

19. The NFER tests measure the progress of the same pupils from year to year as they move through Key Stage 2. Over the period 2000 to 2002, the age-standardised scores have shown that, on average, pupils in Years 4 and 5 make greater progress than might have been expected simply from the fact that they are a year older. The rate of improvement slowed down between 2001 and 2002.

20. Preliminary analysis of the results of boys and girls shows variation over the period 1999 to 2002. NFER findings indicate that boys achieved higher age-standardised scores than girls between 1999 and 2002 in all year groups. In contrast, girls were performing better than boys in English during the same period.

21. Tables 1–3 summarise the areas of mathematics in which pupils made the greatest amount of progress between 2001 and 2002, as well as those areas in which they were still having the greatest difficulty. The information is drawn from the written evaluation tests administered in the 300 sample schools.

Table 1. Year 3 tests

Most progress	Most difficulty
Recognition of squares and triangles	Calculation involving mixed operations with addition and subtraction
Inserting signs (+, -, x, ÷, =) to complete mathematical statements	Completing and interpreting a bar chart, in a context of time
Measuring to the nearest half centimetre, using a given scale	Subtraction of multiples of 5, using the term 'difference'
	Solving problems in the context of shopping – finding change
	Solving problems in the context of shopping using division, with remainder

Table 2. Year 4 tests

Most progress	Most difficulty
Predicting a number, following a pattern, on a number square	Solving problems in the context of shopping, using addition and subtraction
Continuing a number sequence, following a rule	Reading a scale, involving conversion of units of capacity
Finding the perimeter of a shape	Mixed-operation problems in context, using fractions and subtraction
Ordering fractions (including mixed numbers) on a number line	Division of a two-digit number by 4
Reading a scale, involving conversion of units of capacity	Estimation of numbers on a number line

Table 3. Year 5 tests

Most progress	Most difficulty
Division of multiples of 1000 by 100	Identification of parallel and perpendicular lines
Multiplication in context	Solving a 'real-life' word problem, using elements of proportion
Identifying a negative number on a number line	Subtraction from a four-digit number
Finding decimal/fraction equivalents	Finding the co-ordinates of a missing vertex of a rectangle
Writing multiples of 2 and 5, using a selection of given digits	Division of a three-digit number by 3 (without remainder)
Mixed-operation problems in context using multiplication and subtraction	

The quality of the teaching of mathematics

22. The quality of teaching has improved steadily over the three years of the strategy, although the first year of implementation showed the biggest improvement. This year, the quality of teaching is at least satisfactory in nine in ten lessons and good in six in ten, although there are differences across the reception year (Year R), Key Stage 1 and Key Stage 2. The highest proportions of good teaching are in Year R and Year 6. The quality of teaching is more consistent across Key Stage 1 than Key Stage 2.

23. The quality of teaching in the oral and mental starter is good in the majority of lessons. Unsatisfactory teaching in this part of the lesson fell from one in eight lessons to one in 12 over the course of the three years of NNS implementation. As in the first two years of the strategy, number was the main focus of work in the oral and mental starter. The features of good teaching in this part of the lesson have remained the same since the strategy began:

- systematic approaches to the development of pupils' counting skills
- the development of pupils' swift recall of number facts
- effective questioning to encourage pupils to explain their calculations
- imaginative use of resources to support teaching and learning.

24. Teaching which promotes pupils' mental calculation strategies is still unsatisfactory in too many lessons. Although more teachers than before encourage pupils to use strategies such as doubling, halving and the use of multiples, they do not give enough emphasis to teaching pupils to support and record their calculations through the use of personal jottings or to explain how they have made them. At Key Stage 2, teachers often overlook the importance of linking pupils' mental strategies to the introduction of expanded and standard written calculation methods.[1]

25. The quality of teaching in the main teaching activity has improved steadily since the first year of the strategy. Teaching is unsatisfactory in only one in nine lessons now, compared with one in five in the first year and one in eight in 2001. A smooth transition from the oral and mental starter to the main teaching activity continues to be a positive feature. Teaching is frequently unsatisfactory when teachers are not clear enough about the purpose of activities or when they set low-level tasks with little challenge.

26. The quality of whole-class teaching has improved substantially, both when it is used as a way of introducing group, paired or individual work and, less frequently, when it is used throughout the lesson. In effective whole-class teaching, the teacher:

- maintains the momentum of the lesson for all pupils
- uses direct teaching successfully
- uses a variety of approaches, such as demonstration and questioning, to focus pupils' attention and to ensure that they make good progress
- provides opportunities for pupils to listen to and discuss contributions to the lesson
- summarises learning
- consolidates pupils' understanding.

[1] *Further details are given in* Teaching of calculation in primary schools, *Ofsted, 2002.*

27. Teachers usually organise pupils into three ability groups. The quality of group work has improved gradually and tasks, as well as the composition of groups, are now matched more carefully to pupils' needs. Teachers now work more frequently with just one group to provide carefully focused teaching while maintaining general oversight of the rest of the class successfully. In some group work, however, teachers rely too much on commercial mathematics schemes and worksheets. These are not always appropriate, either because they do not encourage pupils to use jottings to support their mental calculations or because they give too much emphasis to practising routine skills.

28. The plenary session remains the weakest part of the daily mathematics lesson. In the first year, one in four plenary sessions was unsatisfactory. This figure fell to one in six in the second year of implementation, but there has been no further improvement this year. The weaknesses continue to be:

- insufficient focus on the lesson's main objectives
- a lack of questioning to reinforce the main teaching points or assess pupils' understanding
- too little diagnosis and resolution of pupils' misconceptions and errors
- too much focus on the work of only one group of pupils with the result that the rest of the class loses interest.

In some instances, the recommended plenary session does not take place at all.

29. There has been little change in the quality of long-, medium- and short-term planning since the initial rapid improvement. It is satisfactory in nine in ten schools and good in about half. It is best when teachers adjust the planned lessons following their day-to-day assessment of pupils' progress or when they consider, before the lesson, some of the errors pupils are likely to make. The planning of plenary sessions remains a weakness, particularly where teachers do not identify clearly enough the questions they intend to ask to assess pupils' understanding.

30. The framework has influenced the quality of planning since the beginning of the strategy. It has improved continuity in teaching and progression in pupils' learning. As teachers have become more familiar with the framework, the amount of time they spend on planning has lessened and there is more sharing of ideas and resources than previously. During the year, some Year 4 and Year 6 teachers have welcomed the unit plans produced by the strategy to support planning. These worked best when teachers adapted them to suit their own classes. Most teachers still plan in some detail, particularly in relation to the coverage of the framework's key objectives, although a significant minority use commercial worksheets uncritically. Teachers now use information and communication technology (ICT) more frequently to write or adapt plans.

31. Teachers' assessment of pupils' progress remains a weakness, although there are signs of improvement in around two in three schools. During the first two years of the strategy, assessment procedures in many schools were inconsistent. Very few teachers used the strategy's 'assess and review' guidance to evaluate pupils' progress or to inform planning. The assessment and monitoring of pupils' progress were left largely to individual teachers and there was little understanding of whole-school assessment. About two in three schools are developing whole-school policies for assessment which set out how:

- end-of-year assessments are used to monitor progress
- pupils are tested at the end of taught units of work

- clear and consistent marking of work can help in the identification and resolution of pupils' errors.

32. Information gained in these ways is recorded in:

- end-of-year profiles of pupils' attainment
- termly or half-termly checks of pupils' progress against the key objectives in the framework
- short-term target-setting.

33. As a result, teachers are able to plan effectively for the next stage of learning and to use the assessments to inform their expectations of pupils' likely progress and attainment. The quality of assessment is linked strongly to the quality of teachers' own subject knowledge in mathematics.

34. A minority of schools are beginning to use the strategy's recent guidance and resources on assessment, but take-up of these materials has been poor because many schools do not know about them. Instead, they either devise their own approaches to assessment or use those which are linked to commercially published schemes.

35. Improving teachers' subject knowledge has been a priority for the strategy from the beginning. Teachers are becoming gradually more knowledgeable about and confident in teaching mathematics. Their understanding of mathematical terms and of progression in pupils' learning has improved, especially in the year groups they teach. They recognise links between topics, such as the relationship between teaching multiplication and teaching division. However, weaknesses remain, particularly in problem-solving and in linking the teaching of mental calculation to written recording. Much of the training provided by the strategy focuses on these areas.

36. Teachers also still find it difficult to:

- identify precisely what groups of pupils need to learn to overcome their difficulties
- think of alternative ways of teaching a topic when pupils do not understand it well.

37. The quality of the teacher's own subject knowledge plays a key part in this. For example, a group of able pupils in Year 6 tried to work out the value of n in the following equation:

$$10 \times n = 1$$

They already knew that letters could stand for numbers, but thought that n = 1. The teacher realised that the pupils did not understand that the unknown value in an equation might be less than a whole number. She therefore showed them similar equations, such as

$$4 \times n = 1$$

helping them to understand that 'if four lots of n' make one whole, then the value of n must be a quarter, so n = 0.25. She was able to:

- diagnose the difficulty
- explain clearly, making links across different topics in mathematics (such as algebra, fractions and decimals)

- provide similar examples.

As a result, the pupils made good progress in overcoming their difficulty and in understanding algebraic conventions.

38. Pupils' responses are at least satisfactory and frequently good in the vast majority of lessons. Pupils have become more enthusiastic about mathematics during the three years of the strategy, helped by teachers' imaginative use of a wider range of resources, such as individual whiteboards, number cards and counting sticks, to give a sharper focus to mental calculation. Teachers motivate pupils by taking time not only to talk about the objectives for a particular lesson, but also to explain to pupils how one lesson links to another. Pupils respond positively to the routines and clear structure of the daily mathematics lesson and they are motivated by direct teaching which involves them fully in the lesson. Many pupils understand their strengths and weaknesses better, as well as the progress they are making. In the very few lessons where pupils do not respond positively, this is often the result of poor classroom management and a failure to match the teaching to what the pupils need to learn.

Use of ICT to support mathematics

39. Schools are now more aware of how to use ICT in mathematics, but progress is slow. In the first two years of the strategy, relatively few schools made regular use of computers for teaching mathematics. Since then, better hardware and the availability of relevant software have improved teachers' opportunities to use ICT with the whole class, for example, in work on data handling, although ICT in Years 5 and 6 is underused in teaching mathematics. Improving teachers' expertise and confidence in using ICT continues to be difficult for many schools.

40. When ICT is used effectively, often because of expertise in ICT within the school, schools are stimulated to improve their resources, enhancing current provision through funding additional to that provided by the National Grid for Learning (NGfL). In contrast, where ICT expertise is more limited, there is less stimulus to improve resources and their use. As a result, the gap between schools, in terms of resources and the good use of ICT, is becoming wider.

41. More daily mathematics lessons are now taught in ICT suites. In the best lessons, in suites and in classrooms, projectors or interactive whiteboards help teachers to demonstrate key concepts before pupils use computers to work in pairs or individually. The most common and successful uses of ICT in mathematics are:

- programmable robots for work on angles and direction
- data-handling software
- programs to help pupils to practise number skills.

42. Where ICT is used most effectively, schools manage their resources well, including the ICT suite. In successful lessons using ICT, teachers use software to model and demonstrate applications and then make sure that pupils apply and practise immediately what they have just learnt. Many schools, however, find it difficult to make the best use of their ICT resources. Some classes do not have enough access to an ICT suite because of inefficient timetabling. The result is that teachers resort to providing low-level, undemanding practice activities for pupils on the classroom computers.

43. Mathematics co-ordinators support teachers' planning and organisation by working with them to select CD-ROMs and other software to match the framework's objectives and pupils' needs. Although the overall range of software is increasing, pupils with special educational needs are often limited to using ICT to practise work in number rather than for investigations and problem-solving.

44. The strategy's potentially helpful ICT software, available since autumn 2001, has had little impact on improving the use of ICT in teaching mathematics. Schools either do not know about it or have not had enough guidance on using it effectively.

Teaching mathematics in reception classes

45. The quality of teaching in reception classes continues to improve. This year, the teaching was satisfactory in all lessons seen and was good in nine in ten. This confirms the evidence from section 10 inspections on the high quality of teaching in this year group.

46. Most reception teachers introduce the elements of the daily mathematics lesson during the autumn term in short sessions throughout the day, usually beginning with an oral and mental starter. These sessions are lively and purposeful and teachers use questions effectively to involve pupils. Further work in mathematics is almost always done in small groups, with carefully planned support from teachers and other adults. The plenary session is included either at the end of a mathematics lesson or as part of a more general discussion at the end of the day. In either case, teachers use the plenary session to reinforce the learning objectives and to assess pupils' understanding. Teaching assistants provide valuable support, particularly where reception pupils are in mixed-age classes.

47. Almost all schools accustom reception pupils to a full daily mathematics lesson by the end of the summer term, or earlier if they feel that pupils are ready. A minority of schools, especially where pupils are admitted to Year R in January or April, do not introduce a full daily mathematics lesson until Year 1.

48. The *Guidance on the organisation of the daily mathematics lesson in reception classes* has been helpful for Year R teachers in emphasising the way in which young children develop their mathematical understanding and vocabulary through practical activities and play.[2]

[2] Guidance on the organisation of the daily mathematics lesson in reception classes, *DfEE, 2000*.

Impact of the NNS on the rest of the curriculum

49. Previous Ofsted reports have indicated that schools were not providing sufficient breadth or depth in their teaching of the non-core foundation subjects. In a report on the primary curriculum earlier this year, HMI reported that headteachers

> *perceive this overload to be the result of the strong emphasis on literacy and numeracy, including the various intervention programmes, and the imperative to improve pupils' performance in the national tests for English and mathematics, measured against increasingly higher annual targets.*[3]

50. There has been some improvement, however. A telephone survey of 50 primary headteachers in March 2002, following up a survey conducted with the same headteachers 12 months earlier, found little change in the time given to history, geography and design and technology, but an improvement in the time given to art and design, music and physical education.

51. Although teachers link mathematics to other subjects, most of these links are incidental, rather than planned with the specific aim of improving pupils' understanding of mathematics. For example, when the focus of art and design lessons was on repetition in print patterns, teachers did not draw pupils' attention to the mathematics of tessellation, reflection or symmetry.

52. A very good example of where pupils used mathematics in another subject occurred in a Year 4 science lesson:

> *The learning objective was to 'carry out a fair test to investigate ways in which parachutes can be changed to alter the amount of air resistance'. Pupils measured the perimeter of a collection of parachutes of different shapes to link the size of the parachute to the speed of its descent. They recorded their results as a table on a whiteboard and the teacher led a whole-class discussion about the conclusions to be drawn from the data.*

53. Headteachers feel that the strategy has had a positive impact on the quality of teaching in other subjects. Teachers are clearer about their objectives and lessons have a more defined structure.

[3] The curriculum in successful primary schools, *Ofsted, 2002.*

Inclusion

Provision for pupils with special educational needs

54. The strategy, and the framework in particular, has had a positive impact on the teaching of pupils with special educational needs (SEN). The framework provides a clear structure for planning and assessing their progress. Many pupils with SEN are able to enjoy and succeed in mathematics and the well-established routines of the daily mathematics lesson increase their confidence. Improved teaching, including practical work and demonstration by the teacher, enables pupils to understand ideas which might otherwise have been difficult for them and to contribute to class discussions. The match of work has also improved and, as a result, the needs of most pupils with SEN are often met successfully through carefully planned group work and the support of teaching assistants. Occasional withdrawal for particular purposes is kept to a sensible minimum.

55. The fast pace of the daily mathematics lesson continues to be a concern for some teachers. They feel that pupils with SEN may fall behind or fail to consolidate their learning, while pupils with attention deficit disorders or behavioural difficulties cannot concentrate for long enough. Although pupils with moderate learning difficulties are taught well, teaching those with more marked needs is still a challenge for many teachers.

56. Teachers' awareness and use of ICT-based resources for pupils with SEN are often very limited and, even when the resources are available, teachers are unsure about how to use them in their mathematics lessons.

57. The role of SEN co-ordinators (SENCOs) in giving advice on teaching mathematics to pupils with SEN is limited. Many are involved in giving advice on literacy, where they often have greater expertise than in mathematics. They carry a range of responsibilities, especially in small schools, in addition to SEN, and have little time to give support or to monitor provision. Few SENCOs work closely enough with mathematics co-ordinators.

58. Many SENCOs and teachers do not have enough training in using the framework to identify mathematical targets for pupils with SEN. Many individual education plans (IEPs) focus primarily on literacy or behaviour. They rarely refer to any additional support for mathematics which might be needed to take account of, for example, delayed linguistic development.

59. Few schools use the P-scales to assess pupils' progress in mathematics. These were devised to support teachers in measuring the progress of pupils working at or below level 2, but their infrequent use means that schools have too few objective measures of pupils' progress.

Support for pupils from Traveller, refugee and asylum-seeker families

60. A small number of schools in the inspection sample include the children of refugees, asylum-seekers and Traveller families. The strategy has brought a number of improvements for these pupils:

- better match of teaching to their needs
- more purposeful deployment of teaching assistants
- teachers' improved awareness of the importance of mathematical vocabulary.

61. The framework provides a common set of teaching objectives for the schools and agencies that work with these pupils. It also provides a clear structure for assessing the progress in mathematics of pupils from refugee and asylum-seeker families and helps to ensure that there are appropriately high expectations of pupils who lack familiarity with English. Traveller support services also use the framework to good effect when they produce support materials for schools, although finding or developing resources that do not place too great a linguistic demand upon some pupils is a problem. For pupils who are learning English as an additional language, whole-class mental and oral activities can be especially difficult unless appropriate support is provided in the classroom.

Intervention

Springboard

62. The strategy's 'catch-up' programmes are designed for pupils who, with support, might be expected to achieve level 4 rather than level 3 in the national tests at the end of Key Stage 2. This year, for the first time, pupils who had received additional numeracy support could be identified within the NFER testing programme. The results show that these pupils made more progress in mathematics from Year 3 to Year 4 and from Year 4 to Year 5 than those who had not received extra support.

63. Springboard 5, for Year 5 pupils, was introduced in the second year of the strategy. Last year's NNS report highlighted weaknesses in its implementation. Many headteachers were reluctant to give teaching assistants responsibility for leading the follow-up sessions; there were weaknesses in the arrangements for training; schools found it difficult to timetable the Springboard lessons; and too few schools monitored pupils' progress or evaluated the impact of the programme.

64. Some of these difficulties have been overcome in Springboard 3 and 4 this year. Teachers and teaching assistants attended training and benefited from planning and working together, and the lesson plans and guidance have been easier to use. Headteachers are more willing to allow teaching assistants to work with small groups of Year 3 and Year 4 pupils because the behaviour of these pupils is often easier to control and the mathematics is simpler. In spite of these improvements, however, only a minority of schools have implemented the programme fully. Many incorporate a Springboard focus within the daily mathematics lesson without the recommended support from a teaching assistant; alternatively, they use the materials simply as an additional resource. Whether or not the programme is appropriate for particular groups of pupils is not always considered carefully enough, and systematic monitoring and evaluation of the impact of the programmes are rare.

65. The demands on staffing, time and accommodation for catch-up lessons are a concern to schools, as is the fact that pupils might miss other subjects in order to attend them. Nevertheless, a minority of schools have been successful in timetabling and teaching Springboard programmes in a way which overcomes these difficulties. These improvements are beginning to have an impact on pupils' progress.

Booster classes

66. The majority of schools have run booster classes. These have been organised in a wide variety of ways. The original recommendation was for a short, focused programme of intensive revision for pupils working towards level 4. In addition to this approach, there is also evidence that schools now:

- employ additional staff to strengthen subject expertise and create flexibility in the way that booster groups are organised
- re-deploy a member of staff who already has sufficient expertise to undertake the booster work
- run year-long programmes for all Year 6 pupils.

67. In the small number of booster lessons observed, the quality of teaching was at least satisfactory and often good. The lessons were sharply focused, structured clearly and based upon accurate assessments of the pupils' needs. Pupils almost always responded well. However, as with other catch-up provision, few schools evaluated the impact of booster classes on raising standards.

The role of teaching assistants

68. Teaching assistants have contributed positively to the successful implementation of the strategy. Most have undertaken training to support the teaching of mathematics, including the Springboard programmes. Effective partnerships between teachers and teaching assistants, as well as teaching assistants' improved subject knowledge and questioning skills, have contributed to improvements in teaching overall, as in this example of a mixed-age Year R/Year 1 class:

> *The teacher and teaching assistant worked together during the initial stages of the mental and oral starter. The teaching assistant was able to select the right moment to shift her attention to a group of pupils who were finding the work difficult. She quickly made sure they were involved fully before moving to her target group for the main teaching activity. The teacher and teaching assistant were alert to the general conduct of the lesson and, through brief exchanges, kept each other informed of pupils' progress. The momentum of the lesson was maintained and the skills of both adults were deployed flexibly in response to the emerging needs of the pupils. Each adult spoke highly of the skills and contribution of the other.*

69. In many schools, classes with younger pupils and catch-up programmes in Key Stage 2 are the priority when teaching assistants are deployed. Although pupils benefit from the support of teaching assistants, schools seldom evaluate their contribution to pupils' learning in any systematic way. A few schools have not capitalised fully upon the potential of their support staff.

Leadership and management

The influence of the headteacher

70. Throughout the implementation of the NNS, reports have highlighted headteachers' leadership as vital in determining the progress made by schools. Leadership and management are at least satisfactory in seven in eight schools and good in almost half. There are still significant weaknesses, however, in the leadership and management in one in eight schools. This proportion is unchanged since the first year of the strategy.

71. In the most effective schools, the headteachers plan their strategies for improvement carefully and make sure they are understood by everyone. They make good use of assessment data, so that the planned improvements take full account of pupils' strengths and weaknesses. They ensure that responsibility for the NNS is shared and that all staff understand the direction of the school's work. For example, the analysis of national test and other data, the observation of teaching (including the scrutiny of planning) and the analysis of pupils' work all help to pinpoint strengths and weaknesses in teaching. They organise high-quality training and involve teaching assistants in it.

72. The effective headteachers encourage collaboration among staff by, for example, putting in place workable systems, including the use of ICT, to make sharing and adapting planning easier. They give active, practical backing to their mathematics co-ordinators, so that they have the time, the knowledge and the status to observe lessons critically, provide feedback and support for teachers and analyse data and other information. Finally, these headteachers recognise that it is not sufficient to instigate change and do things differently; they also monitor and evaluate the impact of change, even when improvement might seem secure.

73. In the one in eight schools where leadership and management are weak, the problems identified in the first year of implementation remain: the headteachers are unfamiliar with how the strategy is developing; they lack knowledge and skill in setting targets; and they delegate responsibility without providing enough support. Even where data are collected and targets set, ineffective headteachers do not do enough to make a difference to teaching, and do not always tackle long-standing problems of staff deployment or weak teaching.

74. While it is undoubtedly harder for some schools than others to bring about improvements, there are examples of schools in challenging circumstances which have improved significantly.

Influence of the mathematics co-ordinator

75. Effective mathematics co-ordinators have been central to the success of the strategy and to the teaching of mathematics in their schools, especially where they work closely with headteachers. The potential of knowledgeable mathematics co-ordinators to influence standards and provide support for colleagues is realised in these schools. Where co-ordinators are senior members of staff, they are often particularly effective.

76. Most co-ordinators provide at least satisfactory subject leadership and management of mathematics. The most effective co-ordinators have maintained the momentum of the strategy by undertaking a demanding range of responsibilities:

- regular and rigorous monitoring of teaching

- detailed scrutiny of pupils' work, including, in some cases, discussion with pupils
- detailed analysis of assessments to inform curricular target-setting
- giving advice on and supporting planning
- introduction of training materials and resources.

77. Such work is most effective when the co-ordinators have received training provided by LEA consultants, inspectors or their headteachers. Some co-ordinators complete formal annual evaluations of the progress of the strategy, including written reports with points for action for staff and governors.

78. One in six co-ordinators provide weak leadership and management. The weaknesses identified in the first two years of implementation continue:

- inexperience and lack of confidence
- poor subject knowledge
- absence of a strategic overview of implementation
- poor communication between the headteacher and the co-ordinator
- little responsibility or support from the headteacher
- limited non-contact time to do the job effectively.

Some co-ordinators are asked to take on the role too early. They do not always have sufficient knowledge or guidance about what the role involves and therefore cannot exercise the leadership which is needed.

79. The increasing importance of the role of co-ordinators is reflected in the national training which began towards the end of the summer term 2002 and is expected to involve all co-ordinators of literacy and numeracy.

Training and support

Training courses

80. The impact of training provided by the strategy has been positive. LEA consultants have played a key role in providing a wide range of good-quality training. The strategy itself has been particularly responsive when weaknesses have been identified in teaching.

81. The three-day and five-day training has been the core of the strategy's programme. The three-day training made sure that the central messages of the strategy were disseminated quickly to schools. The five-day training focused initially on schools which needed intensive support, but has now extended to include teachers from all schools. For many schools, such training has been valuable in ensuring that teachers are familiar not only with the strategy, but also with their LEA's network of support.

82. The content of the five-day training has been revised regularly. This year's training has emphasised problem-solving and questioning. The need to improve teachers' subject knowledge, for example in teaching written calculations, has also been tackled in the revisions to the materials. Better subject knowledge is having an impact on many teachers' planning and teaching, but the test results show that it has not yet made enough difference to some aspects of mathematics.

83. The strategy has also provided a range of other materials and training: for teaching assistants, teachers in the foundation stage and support for focused 'assess and review' lessons. These materials have enabled LEAs to tailor their training to schools' particular needs. For example, in areas where schools have employed a large number of teachers from overseas, LEAs have arranged numeracy courses based on the strategy's materials. More recent training has focused on particular year groups, such as programmes for Year 5 teachers working with more advanced pupils.

84. Weaknesses in training and dissemination remain:

- important messages from training are not always disseminated effectively to all staff by those who have attended
- written materials do not always reach schools because they do not know how to obtain them
- the focus of consultants' support for schools does not always derive from sufficiently careful identification of what schools need in order to improve.

A particular weakness in training this year has been the lack of impact of the LEA conferences for headteachers held in the autumn term, 2001.

Leading Mathematics Teachers

85. The Leading Mathematics Teachers (LMT) initiative, introduced in September 1999, enables teachers to observe the teaching of the daily mathematics lesson by a skilled teacher. LMTs made valuable early contributions to the development of the strategy, for example, by contributing to training sessions in their LEAs. Many of them have been influential in changing teachers' approaches, such as by showing them how to use resources such as arrow cards or by demonstrating good teaching of oral and mental starters. However, stubborn weaknesses continue in this initiative. Many headteachers send teachers to observe demonstration lessons, but do not make clear enough what they need to focus on to improve their teaching. In too many schools, sending staff to observe lessons has not been built into a coherent plan for school improvement. In many LEAs, there has been a gradual decline in the use of LMT schemes by schools.

86. LEAs recognise that they need to do more to make good use of the LMT initiative, such as linking schools or teachers who require support to particular LMTs. In one LEA, the consultant plays a central part in this, identifying possible links and then participating in the lesson observations and discussions to ensure that the teacher benefits. In another, LMTs are asked to focus their demonstration lessons on topics that have been identified as areas of weakness, either within an individual school or across a LEA. In some LEAs, teachers attending the five-day training courses are given an extra training day to observe a demonstration lesson by a LMT.

87. More recently the strategy has made good efforts to re-energise this initiative. Conferences have been held to update LMTs on developments in the strategy and to discuss their role. A number of LEAs have used these conferences effectively to refocus their own efforts. A particular weakness in some LEAs, however, is the lack of sufficiently rigorous selection, monitoring and evaluation procedures to ensure that LMTs are effective in improving teaching and raising standards.

LEA consultants

88. Within the first term of the strategy, LEA consultants quickly established good working relationships with their schools. At the end of the first year, around eight in ten schools receiving intensive support felt that it had been good or very good. Consultants' experience and expertise grew in the second year. Their work extended to include non-intensive schools where their support was also welcomed, particularly where it focused on clearly identified issues.

> *A school carried out an audit of teachers' subject knowledge and, in response, arranged for the consultant to lead two twilight training sessions in the areas in which teachers lacked confidence. An important part of the consultant's support was helping the school to monitor and sustain the changes through joint observations of teaching and the scrutiny of planning.*

89. Consultants' support for schools does not always form part of a coherent action plan for mathematics which schools are committed to following through in a systematic way. The strategy has recognised this and has provided materials for LEAs to train co-ordinators in self-evaluation and action planning. LEAs are becoming more rigorous in focusing carefully the work of NNS consultants on the schools that need it most and following up the support that is provided.

LEA support

90. The extent and quality of the support given by link advisers and inspectors to schools continue to be very uneven across LEAs. While most headteachers have discussions with their link inspectors about the setting of numerical targets for the end-of-key-stage tests, more focused support for mathematics is less common. However, where LEAs carry out regular school reviews, including observations of the teaching of mathematics, the schools receive useful feedback. A small number of LEAs have recognised the need for stronger links between their school improvement and NNS teams to ensure more co-ordinated approaches to raising standards.

Conclusion

91. The numeracy strategy has brought about radical, much-needed change in the way mathematics is taught in English primary schools. It has provided teachers with the tools and the confidence to regain control of the teaching of mathematics, rather than relying, as happened too often in the past, on pupils working their way through textbooks and worksheets. They are more prepared to interact with the whole class through direct teaching and to extend this to their work with small groups. The strategy's impact on the quality of teaching has been good.

92. This positive impact has been reported by Ofsted since the strategy was piloted in 12 LEAs in 1996/97, when it was known as the National Numeracy Project. It was clear from the beginning, however, that many teachers were having difficulty with the plenary session in the daily mathematics lesson. Although the proportion of lessons where the plenary session is weak has diminished since 1996 from half to one in six, this still represents too many lessons. This is particularly worrying, as this part of the lesson is about assessing pupils' progress and identifying exactly what they need to learn next. The steps already taken by the strategy to tackle these weaknesses have not been effective enough. More needs to be done to help teachers to get better at 'thinking on their feet' about the impact of their teaching on pupils' learning during lessons.

93. Not all teachers are using the strategy's assessment materials to improve planning and teaching; some do not know about them. Too often, teachers do not have good-quality assessment information to help them identify those pupils who need additional support or intervention programmes. The ability of teachers to diagnose pupils' learning needs and adapt their teaching to meet them holds the key to higher standards.

94. The report describes weaknesses in the management of the Springboard programme by schools that need to be remedied urgently if Springboard is to fulfil its potential. Although the results of the NFER tests show the positive impact of Springboard on pupils' progress, its management at school level is unsatisfactory in too many schools.

95. Training for teachers has been a substantial part of the strategy. There is no doubt that it has improved many teachers' understanding of, and ability to teach, mathematics. The emphasis on improving teachers' subject knowledge needs to continue, however, especially to improve day-to-day assessment and the use of the plenary session for identifying pupils' weaknesses.

96. Weak leadership and management of the strategy are a significant barrier to progress in one in eight schools. Too many of the headteachers in these schools remain unconvinced that their schools can raise standards from a low starting point. They have not seen the potential of the strategy to boost attainment and improve teaching and, consequently, they have not provided the leadership that the strategy expects of them.

97. The strategy has had a positive impact on pupils' attainment in the national tests at Key Stages 1 and 2. Although the majority of schools have been successful in raising standards, too many have found it difficult to sustain improvements from one year to the next. The biggest gains in attainment were recorded in the first year of the strategy, but the target set by the government of 75% has been missed by two percentage points. Further improvement in standards will not require a change of direction or an overhaul of the framework for teaching. It will require the things that are already in place to be done better.

Executive summary of the technical report

98. In 1999 the National Foundation for Educational Research (NFER) was asked to organise a yearly testing programme to support the evaluation of the National Numeracy Strategy (NNS) being undertaken by Ofsted. The testing programme was commissioned by the Qualifications and Curriculum Authority (QCA). The evaluation was originally commissioned for three years duration. However, at the end of testing in the third year, it was decided to extend the evaluation for a further year in order to track Year 3 pupils in 1999 to Key Stage 2 in 2002. Thus, a unique data set was established and it has been possible to track the progress of a cohort of pupils, from Key Stage 1 through to Key Stage 2. This summary draws on data collected from before the introduction of the NNS to the end of its third year of implementation.

99. The testing programme focused on pupils in Years 3, 4 and 5 and aimed to provide a detailed picture of changes in standards and progress from Key Stage 1 to Key Stage 2. Tests for written and mental mathematics, similar in content to the QCA optional tests for Years 3, 4 and 5, were specially developed for exclusive use in the evaluation. Age-standardised scores were calculated and national curriculum levels awarded for all pupils who completed all parts of the test.

100. Ofsted provided a sample of 300 schools that were asked to administer the numeracy tests to all of their Year 3, 4 and 5 pupils each summer term. Tests were despatched and administered in schools under secure conditions and completed tests were returned to NFER for marking. Schools were also asked to provide some background information about their pupils to inform the analysis. Raw scores from the tests, together with background data, were used to assemble a database each year. A numbering system was devised so that individual pupils taking part in the testing could be tracked from one year to the next. Schools received feedback in terms of scores and national curriculum levels for each of their pupils. They also received charts and tables comparing their pupils' performance and progress to the whole cohort. Because of the confidential nature of the tests, pupils' test booklets were retained at NFER, except in the final year where they were returned to schools at their request.

101. In the first year of the evaluation, 294 sampled schools participated. The majority of schools continued to support the evaluation throughout the course of the project and, in 2002, 289 schools participated for the fourth time. Substantial numbers of pupils were included in the database that has been built up over the four years (an average of around 10,800 pupils per year group) and the majority of these pupils were tested on more than one occasion. In each year of the evaluation, the sample of schools and pupils has been broadly representative of the whole-school population in terms of size, type of school and geographical location. In the 2002 sample, there were slight differences in the distribution of Key Stage 2 performance when compared with the whole-school population. As in previous years, this was taken into account during the statistical analysis of the data.

102. Each year, a range of analysis strategies has been used. At a simple level, it was possible to compare the performance of whole-year groups in 1999, 2000, 2001 and 2002 to look for changes in average age-standardised scores over time. For mathematics there were consistent improvements in scores in all three year groups, from summer 1999 to summer 2001. The increases at the end of the first year of testing were most marked, as might be expected; this was also the first year of the implementation of the numeracy strategy. However, in 2002 the mean age-standardised scores for pupils taking the numeracy tests remained very similar to those observed in 2001, suggesting that previous improvements in achievement have been maintained and that there now appears to be a levelling of pupils' performance.

103. The distribution of levels for each of the Year 3, 4 and 5 tests reflects a similar picture. In summer 2002, the proportions of pupils achieving each level were very

similar to those observed in 2001. This indicates that the continuing improvements in performance in the first three years of the evaluation have slowed down in the fourth year, but that the improved standards have been sustained. It is important to note that, since the first year of the evaluation, the proportion of pupils achieving the highest level in each test year has significantly increased and the proportion of pupils failing to reach the lowest level measured by the tests has decreased. For example, the proportion of pupils achieving level 4 or better in the Year 5 numeracy tests increased from 33% in 1999 to 45% in 2002.

104. For pupils who were tested on more than one occasion between 1999 and 2002, it was possible to analyse the progress they made from year to year. Simple comparison of changes in average age-standardised scores and national curriculum levels were further examined using sophisticated multilevel statistical models. This statistical technique is used to examine data sets where there are many variable factors that might affect the outcome of a test. Applying a multilevel modelling technique enables the relationship between each individual factor to be measured, independently of all others, and thus the strength of the relationship between each factor and the outcome can be determined. It is very important to remember that age-standardised scores take into account improvements that are expected as a result of increasing maturity. A child of average ability in Year 4 who had an age-standardised score of 100 would be expected to have an age-standardised score of around 100 in Year 5. Any change in age-standardised score over time implies greater than expected change in the knowledge, skills and achievement measured by the tests.

105. The large amount of pupils' test scores gathered during the course of the evaluation has made it possible to map how pupils progress throughout the four years of Key Stage 2. Most schools provided NFER with prior attainment data in mathematics for the end of Key Stage 1 assessments. In addition, the majority of schools consented to the use of their Key Stage 2 results for 2000, 2001 and 2002 for their pupils who were in Year 5 in 1999, 2000 and 2001 respectively. Comparing three different types of assessment (Key Stage 1, evaluation tests and Key Stage 2) has some inherent difficulties in terms of variation in test structure and outcome but, despite these, some useful observations can be made. From 1999 to 2002 there have been changes in patterns of attainment, not just in relation to the evaluation tests, but also in the profile of achievement at the end of Key Stage 1. The small proportion of the sample pupils coming into Year 3 assessed as level 1 or 'working towards' level 1 in mathematics has slightly decreased over the last four years from 2% in 1999 to 1.5% in 2002. It would appear that it is difficult for pupils at this low level to progress up to level 2 over the course of one year.

106. Monitoring the progress of pupils in the sample schools over time has shown that progress in mathematics appears to be generally steady throughout the four years of Key Stage 2. In 2002, 90% of Year 3 pupils assessed at level 2A went on to achieve level 3 or better in the Year 4 test and 90% of pupils assessed at level 3A or better moved up to level 4 or better in Year 5. The majority of pupils assessed at level 3 in Year 5 went on to achieve at least level 4 at the end of Key Stage 2.

107. From previous years' analyses, it is known that a number of background factors can affect the scores pupils achieve in their tests. During the evaluation, traditional statistical analyses and multilevel modelling have demonstrated relationships between some background factors and scores. By far the most significant relationship was between prior attainment (measured as the level achieved at Key Stage 1) and age-standardised scores, in all of the year groups tested. Pupils who performed well at Key Stage 1 were very likely to have higher scores in subsequent years. The multilevel model, taking into account the levels achieved at Key Stage 1, found that in Years 3, 4 and 5, boys gained higher scores than girls in the numeracy tests. Pupils with higher levels of fluency in English had higher scores. After taking into account all other factors, Chinese children performed better in mathematics in all three year groups and Indian

pupils performed better in Years 4 and 5. From the first round of testing it was evident that some background factors had a very strong relationship with lower scores; children eligible for free school meals and those with identified special educational needs generally had lower scores after allowing for differences in prior attainment.

108. The multilevel model was used to examine the effect of background factors on the progress that pupils in the evaluation made from year to year. Girls made less progress than boys from Year 3 to Year 4 but between Years 4 and 5 boys and girls made equivalent progress. Pupils in Years 4 and 5 made similar progress in mathematics, regardless of their level of prior attainment. In 2002 the multilevel model found that pupils with special educational needs made the same progress as pupils without in both time periods, Years 3 to 4 and Years 4 to 5. Pupils from Bangladeshi, Chinese and 'other' ethnic groups made more progress than white pupils from Year 3 to Year 4. Although pupils with higher levels of fluency in English tended to have higher scores, in 2002 it was found that pupils with lower levels of fluency were making equivalent progress to that of more fluent pupils during Year 4 to Year 5. In previous years, pupils eligible for free school meals have generally made less progress than pupils who are not eligible. However, in 2002, the multilevel model found such pupils to be making the same progress as their peers. For the first time in 2002, pupils who had received additional numeracy support could be identified and the multilevel model found that these pupils made more progress in mathematics from Year 3 to Year 4 and Year 4 to Year 5 than those who had not received extra support. Between Years 4 and 5, summer-born children made less progress in mathematics than children born in the autumn.

109. As in previous years of the evaluation, in 2002 various school-level factors were included in the model to investigate their relationship with attainment and progress. Throughout the course of the evaluation, it has generally been found that pupil-level factors have stronger relationships with scores and progress than school-level factors. However, some school variables were found to have a significant effect on pupils' attainment and progress. For example, schools making effective use of their LEA consultant made more progress between Years 4 and 5. Pupils from schools with more stable populations had higher scores in Years 4 and 5 and the size of the school had an effect as pupils from larger schools tended to have lower scores in Year 5.

110. Individual pupil responses to questions in both the mental and written tests were collected so analysis at item level could be examined. In 2002, there were minor changes in the six mathematical skill areas tested compared with 2001. It is important to note, however, that over the four years of the evaluation there have been marked improvements in each skill area. For example, Year 3 pupils in 2002 gave 12% more correct answers to mental arithmetic questions on data handling than the corresponding group of pupils did in 1999. Similar levels of improvement occurred in written mathematics in the area of knowledge of numbers and in mental mathematics in the area of measures in Years 4 and 5.

111. To conclude, the first three years of the evaluation saw significant improvements in pupils' performance in both mental and written mathematics. The results from the evaluation in 2002 indicate that previous improvements have been sustained, indicating a levelling of pupils' performance. Average age-standardised scores did increase over and above what would be expected from 1999 to 2001. However, little change occurred from 2001 to 2002 and thus the distribution of national curriculum levels in Years 3, 4 and 5 was very similar in 2002 compared with 2001. It is important to note that levels of achievement have improved substantially over the four years of the evaluation and that the proportion of pupils unable to reach the lowest level measured by each test has continued to fall. These findings alone cannot assess the impact of the NNS, but they do provide sound statistical evidence that the improvements in achievement observed in the first three years of the evaluation, for all groups of pupils, have been maintained during the final year.

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